

REMARKS

Applicants respectfully request the Examiner to reconsider the present application in view of the foregoing amendments to the claims and the following remarks.

Status of the Claims

Claims 1, 2, 4-8, 13, 15, 16, 18 and 19 are currently pending in the present application. The Office Action is non-final. Claims 1, 6, and 13 have been amended and claims 3 and 14 have been cancelled without prejudice or disclaimer of the subject matter contained therein. No new matter has been added by way of the amendments. For instance, claim 6 has been amended to include textual subject matter taken from claim 3, now cancelled. Claims 1 and 13 were amended to further define the invention. Thus, no new matter has been added.

Based upon the above considerations, entry of the present Amendment is respectfully requested.

Issue regarding Information Disclosure Statement (IDS)

The Examiner indicates that the IDS filed July 17, 2008 fails to comply with 37 C.F.R. § 1.98(a) (2), which requires a legible copy of each cited foreign patent document. A new IDS is being filed on even date herewith, which includes the following references.

(1) Document CA, IMONO, The JOURNAL OF THE JAPAN FOUNDRYMEN'S SOCIETY, Vol. 64, No. 8, pp. 562-567, (1992).

(2) Document CB, Extract translation of technical report, "Application of Mullite Ceramic Beads to Mold Sand" (5 pages).

(3) Document CC, Akira Takahashi, "Report on Particle Shape Analysis Using Binary Image Analysis," pp. 1-3, (2008).

(4) Notice of Opposition dated April 17, 2008 through the European Patent Office.

Objection to the Specification

The specification is objected to due to informalities. The Examiner suggests that on page 5, line 7, "resistant" should be replaced with "resistance." Applicants have amended the specification as the Examiner suggested.

Further, it is unclear to the Examiner what is meant by "JIS K 6721" which is found on page 21, line 19, of the present specification. **For the convenience of the Examiner, Applicants herein provide as Exhibit 1, a copy of JIS K 6721.**

As described at page 21, lines 18-19 of the present specification, "a funnel according to JIS K 6721" means the funnel recited in JIS K 6721. JIS K 6721 relates to "Testing Methods for Polyvinyl Chloride." At section 3.3, "Bulk Specific Gravity," subsection 3.3.1 (1), "Measuring Instrument of Bulk Specific Gravity," JIS K 6721 indicates "The measuring apparatus for bulk specific gravity given in Fig. 2." In Fig. 2 (JIS K 6721, page 7), the funnel Applicants referred to is shown. Accordingly, "a funnel according to JIS K 6721" is clear to a person skilled in the art.

Applicant respectfully requests reconsideration and withdrawal of the present objection.

Claim Objections

Claims 1 and 13 are objected to as allegedly being in improper dependent form for failing to further limit the subject matter of a previous claim. The Examiner asserts that claim 6 recites

“weight ratio of 0.9 to 17,” while claims 1 and 13 recite “weight ratio of 1 to 15,” which is inconsistent because these are specific values rather than ranges. Applicants respectfully traverse.

Although Applicants disagree, in order to further prosecution, Applicants have amended claims 1 and 13, without prejudice or disclaimer of the subject matter contained therein, to further define “...the $\text{Al}_2\text{O}_3/\text{SiO}_2$ weight ratio of from 1 to 15....” Additionally Applicants have amended claim 6, without prejudice or disclaimer of the subject matter contained therein, to further define “...the $\text{Al}_2\text{O}_3/\text{SiO}_2$ weight ratio of from 0.9 to 17....”

Applicants submit that claims 1 and 13 further limit the spherical molding sand weight ratio within the range disclosed in claim 6, as well as further limit the average particle size of 0.05 to 1.5 mm.

By the above claim amendments, it is clarified that the weight ratio are ranges rather than specific values. Further, Applicants submit that there is consistency within the claims since claim 6 defines the range of the weight ratio for materials while claim 1 defines the range of the weight ratio for the end product.

Applicant respectfully requests reconsideration and withdrawal of the present objection.

Issues Under 35 U.S.C. § 103(a), Obviousness

The Examiner has cited the following rejections under 35 U.S.C. § 103(a), below.

Claims 1, 6, 18, and 19 stand rejected under U.S.C. § 103(a) as unpatentable over Kobayashi *et al.*, U.S. Patent No. 6,054,073 (hereinafter “Kobayashi”), in view of JP 5-169184 (hereinafter “JP ‘184”).

Claims 2-5, 7, 8, and 13-16 stand rejected under U.S.C. § 103(a) as unpatentable over Kobayashi, in view of JP '184 and further in view of Anzai *et al.*, U.S. Patent No. 4,923,520.

Legal Standard for Determining Prima Facie Obviousness

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a *prima facie* case of obvious was held improper.).

"In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the

proposed substitution, combination, or other modification.” *In re Linter*, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. “The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art.” *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also *In re Lee*, 277 F.3d 1338, 1342-44, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002) (discussing the importance of relying on objective evidence and making specific factual findings with respect to the motivation to combine references); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The Supreme Court of the United States has recently held that the teaching, suggestion, motivation test is a valid test for obviousness, but one which cannot be too rigidly applied. See *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct 1727, 82 USPQ2d 1385 (U.S. 2007). The Supreme Court in *KSR Int'l Co. v. Teleflex, Inc.*, *ibid.*, reaffirmed the Graham factors in the determination of obviousness under 35 U.S.C. § 103(a). The four factual inquiries under Graham are:

- (a) determining the scope and contents of the prior art;
- (b) ascertaining the differences between the prior art and the claims in issue;
- (c) resolving the level of ordinary skill in the pertinent art; and
- (d) evaluating evidence of secondary consideration.

Graham v. John Deere, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (U.S. 1966).

The Court in *KSR Int'l Co. v. Teleflex, Inc.*, *supra.*, did not totally reject the use of "teaching, suggestion, or motivation" as a factor in the obviousness analysis. Rather, the Court recognized that a showing of "teaching, suggestion, or motivation" to combine the prior art to meet the claimed subject matter could provide a helpful insight in determining whether the claimed subject matter is obvious under 35 U.S.C. § 103(a).

Even so, the Court in *KSR Int'l Co. v. Teleflex, Inc.*, *ibid.*, rejected a rigid application of the "teaching, suggestion, or motivation" (TSM) test, which required a showing of some teaching, suggestion, or motivation in the prior art that would lead one of ordinary skill in the art to combine the prior art elements in the manner claimed in the application or patent before holding the claimed subject matter to be obvious.

Accordingly, while the courts have adopted a more flexible teaching, suggestion, motivation (TSM) test in connection with the obviousness standard based on the *KSR v. Teleflex* case, which case involved a mechanical device in a relatively predictable technological area, it remains true that, despite this altered standard, the courts recognize inventors face additional barriers in relatively unpredictable technological areas as noted in *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 83 USPQ2d 1169 (Fed. Cir. 2007).

Further, the Examiner bears the initial burden of presenting a *prima facie* case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336,

quoted with approval in *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741, 82 USPQ2d 1385, 1396 (2007).

M.P.E.P. § 2143 sets forth the guidelines in determining obviousness. But before the Examiner can utilize these guidelines, the Examiner has to take into account the factual inquiries set forth in *Graham v. John Deere*; *supra*. To reject a claim based on the above mentioned guidelines, the Examiner must resolve the *Graham* factual inquiries. MPEP §2143.

If the Examiner resolves the *Graham* factual inquiries, then the Examiner has to provide some rationale for determining obviousness, wherein M.P.E.P. §§ 2141 and 2143 set forth the rationales that were established in *KSR Int'l Co. v Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

Exemplary rationales are set forth in MPEP §§ 2141 and 2143 that may support a conclusion of obviousness, and include:

(a) *combining prior art elements according to known methods to yield predictable results;*

(b) *simple substitution of one known element for another to obtain predictable results;*

(c) *use of known technique to improve similar devices (methods, or products) in the same way;*

(d) *applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;*

(e) *“obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success*

(f) *known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;*

(g) *some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.*

Additionally, MPEP § 2143.03 clearly directs that all claim limitations must be considered in view of the cited prior art in order to establish a prima facie case of obviousness.

Applicants respectfully submit that the Examiner has not appropriately resolved the *Graham* factors, including the factors of determining the scope and content of the prior art and ascertaining the differences between the prior art and the claims that are at issue. Based on the following, Applicants maintain that the above mentioned *Graham* factors actually reside in Applicants' favor. Additionally, Applicants submit that since the Examiner did not resolve the *Graham* factors, the rationale the Examiner provides for combining the cited references is improper.

Applicants respectfully submit that the present invention is distinct from the cited references and that the Examiner is basing the Examiner's assertions on hindsight reconstruction.

Distinctions Over the Cited Art

Rejection of claims 1, 6, 18, and 19 based on Kobayashi, in view of JP '184.

The Examiner asserts that Kobayashi discloses a method for producing inorganic spherical sand particles where the method includes supplying raw material (powder, with a range in size from 0.5 to 200 μm) through a burner to pass through a flame (fusing in flame), in which the particles of the raw material include silica, alumina, or a double oxide such as mullite, thus forming spherical particles.

The Examiner admits that Kobayashi does not specifically disclose the alumina/silica weight ratio of 0.9 to 17 for the spherical sand particles (or its use as a casting mold). Yet, the Examiner then asserts that JP '184 discloses high siliceous spherical molding sand (as well as its

production and use as a casting mold) with a resultant <1 to 4 alumina/silica weight ratio. The Examiner also suggest that JP '184 also discloses that this spherical molding sand composition is advantageous for providing excellent molding strength (as a casting mold) during a casting process, as well as dimensional accuracy and removal of the sand after casting.

In light of this, the Examiner asserts that it would have been obvious to modify Kobayashi's fusing in flame method for producing inorganic spherical sand particles by using an alumina to silica weight ratio of <1 to 4, as taught by JP 5-169184, in order to provide excellent molding strength (as a casting mold) during a casting process. Applicants respectfully traverse.

Although Applicants disagree, in order to further prosecution, Applicants have amended claim 1, without prejudice or disclaimer of the subject matter contained therein, to further define "...the $\text{Al}_2\text{O}_3/\text{SiO}_2$ weight ratio of from 1 to 15...." Additionally Applicants have amended claim 6, without prejudice or disclaimer of the subject matter contained therein, to incorporate the textual subject matter of non-rejected claim 3, now cancelled.

As indicated by the Examiner, Kobayashi does not specifically disclose that the alumina/silica weight ratio of the spherical sand particles is 0.9 to 17, as well as its use as a casting mold. Additionally, the Examiner also indicated that neither Kobayashi nor JP '184 specifically disclose low water absorbency.

The Examiner refers to the combination of Kobayashi with JP '184. Kobayashi, however, relates to a Flame Fusion Method operated at or above 1800 °C while JP '184 relates to a Granulation Calcination Method where calcination is carried out at 1300-1700 °C after granulation by spray-drying. Applicants submit that the products obtained by both methods are quite different from each other as exemplified by the Sakaguchi Declaration filed in the previous

response dated July 18, 2008. Applicants herein incorporate by reference the description of the differences of the two methods. For sake of convenience of the Examiner, Applicants supply, in part, these descriptions from Mr. Sakaguchi's Declaration, below.

Example Prepared by the Flame Fusion Method

This Example corresponds to Example 3 presented within the specification at page 16 line 14 and is discussed in detail below.

A mullite powder (synthetic mullite powder manufactured by Shibata Ceramics Co., Ltd.) containing 97% by weight of Al_2O_3 and SiO_2 in a total amount and having an Al_2O_3/SiO_2 weight ratio of 2.7, a water content of 0.1% by weight, an average particle size of 0.25 mm, and a major axis diameter/minor axis diameter ratio of 1.3 was used as a starting material.

This powder was supplied by using oxygen as a carrier gas to flame (about 2000°C) which was generated by combustion of LPG (propane gas) in a ratio of LPG/oxygen of 1.1 (volume ratio), to give a monodispersed spherical molding sand.

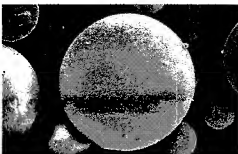
The resulting molding sand contained 98% by weight of Al_2O_3 and SiO_2 in a total amount and had an Al_2O_3/SiO_2 weight ratio of 2.7, an average particle size of 0.21 mm, a spherical degree of 0.99, water absorption of 0% by weight, and a particle density of 3.1 g/cm³. The enclosed photograph of this molding sand example is depicted on the left hand side of the enclosed figure. It can be seen from the left hand side photograph that every molding sand particle is spherical.

Comparative Example Prepared by the Granulation Calcination Method

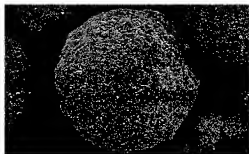
This Comparative Example corresponds to Comparative Example 1 presented within the specification at page 19 line 19 and is discussed in detail below.

Powdery particles (containing 96% by weight of Al_2O_3 and SiO_2 in a total amount), which were prepared by mixing aluminum hydroxide with kaolin so as to have an Al_2O_3/SiO_2 weight ratio of 2.7 and subjecting the mixture to a treatment using a spray-dryer to form spherical particles, were calcined in an electric furnace at 1500°C for 1 hour, to give a spherical molding sand. The resulting molding sand contained 97% by weight of Al_2O_3 and SiO_2 in a total amount and had an Al_2O_3/SiO_2 weight ratio of 2.7, an average particle size of 0.18 mm, a spherical degree of 0.89, water absorption of 1.2% by weight, and a particle density of 2.7 g/cm³. A photograph of this molding sand is shown on the right hand side of the figure below. It can be seen from the right hand photograph within the figure below these molding sand particles have a low spherical degree and are pitted.

Flame Fusion Method Example



Granulation Calcination Method Example



	Flame Fusion Method Example	Granulation Calcination Method Example
Total Al_2O_3 and SiO_2 (wt. %)	98%	97%
$\text{Al}_2\text{O}_3/\text{SiO}_2$ weight ratio	2.7	2.7
Average particle size (mm)	0.21	0.18
Spherical degree	0.99	0.89
Water absorption (wt. %)	0%	1.2%
Particle density of (g/cm^3)	3.1	2.7

Mr. Sakaguchi described in detail the differences between the two methods, which as indicated in the supplied photographs were quite dramatic. Accordingly, a person skilled in the art would not be motivated to combine both methods.

With regards to the Examiner assertion that JP '184 teaches the alumina to silica weight ratio of <1 to 4, Applicants respectfully disagree with the Examiner interpretation of the text found in the abstract of JP '184. The Abstract mentions:

"...When SiO_2 is included at a rate exceeding 80% of the weight and the content of Al_2O_3 has the chemical composition which is less than 20% of the weight...."

Based on the above, the range the Examiner cites is incorrect. If one calculates a range from the above statement, the SiO_2 is greater than 80% ($X > 80\%$) and the Al_2O_3 content is less than 20% ($Y < 20\%$). The lowest percentage of SiO_2 is 81% and its highest percentage is 100%.

The lowest percentage of Al_2O_3 is 1% (or zero, for simplicity, use 1%) and its highest percentage is 19%. Therefore, the lowest value for the ratio of $\text{Al}_2\text{O}_3/\text{SiO}_2$ is 1/81 (0.12), while the highest value for the ratio of $\text{Al}_2\text{O}_3/\text{SiO}_2$ is 19/100 (0.19).

As indicated in the presently amended claim 6, the $\text{Al}_2\text{O}_3/\text{SiO}_2$ weight ratio is of from 0.9 to 17, while the range cited by the Examiner for JP '184 is below this range (0.12-0.19).

As indicated by the Examiner, Kobayashi does not specifically disclose that the alumina/silica weight ratio of the spherical sand particles is 0.9 to 17, as well as its use as a casting mold. Applicants respectfully submit that JP '184 also does not disclose this range. Additionally, the Examiner also indicated that neither Kobayashi nor JP '184 specifically disclose low water absorbency. Based on the differences between the two types of method discussed above, Applicants submit that the products from Kobayashi and JP '184 are completely different and a skilled artisan would not consider combining these two different methods to attempt to form the present invention.

In light of the above presently amended claims and remarks, because there is no disclosure, teaching, suggestion, reason or rationale provided in the Kobayashi reference that would allow one of ordinary skill in the art to arrive at the instant invention as claimed, it follows that the same reference is incapable of rendering the instant invention obvious under the provisions of 35 USC § 103(a). Based upon the above, and applying the *Graham factors* analysis test, it is submitted that a *prima facie* case of obviousness has not been established.

Since the present invention is not obvious in light of Kobayashi, the combinations of Kobayashi and JP '184 also fail. The secondary reference, JP '184 does not cure the deficiencies of Kobayashi. Therefore, the combinations of Kobayashi and JP '184 do not arrive at the present

invention. Based upon the above, and applying the *Graham factors* analysis test, it is submitted that a *prima facie* case of obviousness has not been established for any of the above mentioned claims.

Applicants respectfully request reconsideration and subsequent withdrawal of the above rejections.

Rejection of claims 2-5, 7, 8, and 13-16 based on Kobayashi, JP '184 and Anzai.

The Examiner asserts that Kobayashi (in view of JP '184) discloses and/or suggests the features of claims 1, 6, 18, and 19, above.

The Examiner admits that neither Kobayashi nor JP '184 specifically discloses the spherical degree being at least 0.95 (or 0.98), as well as the low water absorbency.

The Examiner does assert, however, that Anzai teaches the use of a fusion in flame process for the purpose of promoting fused silica particles having spherical degree of more than 0.99 (or 99 volume percent), of which are in nearly perfect spherical form, and a very low water absorption of about 0.21 wt%, which is much lower than 0.8 wt% as claimed. Further the Examiner asserts that it would have been obvious to modify the method for producing inorganic spherical sand particles through a fusing in flame process, as disclosed by Kobayashi, by using an alumina to silica weight ratio of <1 to 4, as taught by JP '184, in order to provide excellent molding strength (as a casting mold) during a casting process, as well as to obtain dimensional accuracy and removal of the sand after casting, and by further using a high spherical degree and low water absorbency, as taught by Anzai, in order to improve flowability, de-gassing and to promote mechanical strength. Applicants respectfully traverse.

With regards to issues concerning Kobayashi and JP '184, Applicants incorporate by reference the arguments from the previous rejection.

With regards to the Anzai reference, Applicants respectfully disagree with the Examiner's comment from the outstanding Office Action that the previous arguments concerning Anzai are moot in light of the new rejections cited.

As discussed in our previous response, based on the teachings of Anzai, Applicants insist that the Anzai reference is an improper reference since it teaches away from the present invention.

For the Examiner's consideration, Applicants provide comments from Mr. Sakaguchi's Declaration, in part, which discuss the Anzai reference:

Anzai uses spherical fused silica of 50 μm or greater (see Anzai column 3 lines 60 - 68) and Anzai mentions that "proportions of particles that are not fully fused, e.g., which do not become non-crystalline throughout, or which are not fully spherical in shape, increase when fused silica having an average particle diameter above 50 μm is to be produced." (Emphasis added)

It appears that Anzai reinforces this limitation in the technology by indicating in the Manufacturing Example, Examples 1-10 and Table 1 that the spherical fused silica were less than 50 μm in diameter (see Anzai, column 4, line 8 to column 6 line 15). One skilled in the art therefore would not use Anzai to produce spherical fused silica of 50 μm or greater due to Anzai warning of producing inferior quality and shape of the fused silica spheres.

Applicants submit that Anzai and Kobayashi are not combinable since the particle sizes of Kobayashi (0.5 to 200 μm ; see Kobayashi column 2, line 53, and column 6, lines 42-49) and

Anzai (<50µm) are incompatible in combination since Kobayashi's size range includes particle sizes above Anzai's limits.

In light of the above presently amended claims and remarks, because there is no disclosure, teaching, suggestion, reason or rationale provided in the Kobayashi reference that would allow one of ordinary skill in the art to arrive at the instant invention as claimed, it follows that the same reference is incapable of rendering the instant invention obvious under the provisions of 35 USC § 103(a). Based upon the above, and applying the *Graham factors* analysis test, it is submitted that a *prima facie* case of obviousness has not been established.

Since the present invention is not obvious in light of Kobayashi, the combinations of Kobayashi with JP '184 and Anzai also fail. The secondary references, JP '184 and Anzai do not cure the deficiencies of Kobayashi. Therefore, the combinations of Kobayashi, JP '184 and Anzai do not arrive at the present invention. Based upon the above, and applying the *Graham factors* analysis test, it is submitted that a *prima facie* case of obviousness has not been established for any of the above mentioned claims.

Applicants respectfully request reconsideration and subsequent withdrawal of the above rejections.

In view of the above remarks, Applicants believe the pending application is in condition for allowance.

CONCLUSION

A full and complete response has been made to all issues as cited in the Office Action. Applicants have taken substantial steps in efforts to advance prosecution of the present application. Thus, Applicants respectfully request that a timely Notice of Allowance issue for the present case.

Should there be any outstanding matters within the present application that need to be resolved, the Examiner is respectfully requested to contact Paul D. Pyla, Reg. No. 59,228, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Dated: DEC 23 2008

Respectfully submitted,

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Attachment: Exhibit 1: English Translation of Japanese Industrial Standard
(JIS) K 6721, "Testing methods for Polyvinyl Chloride."